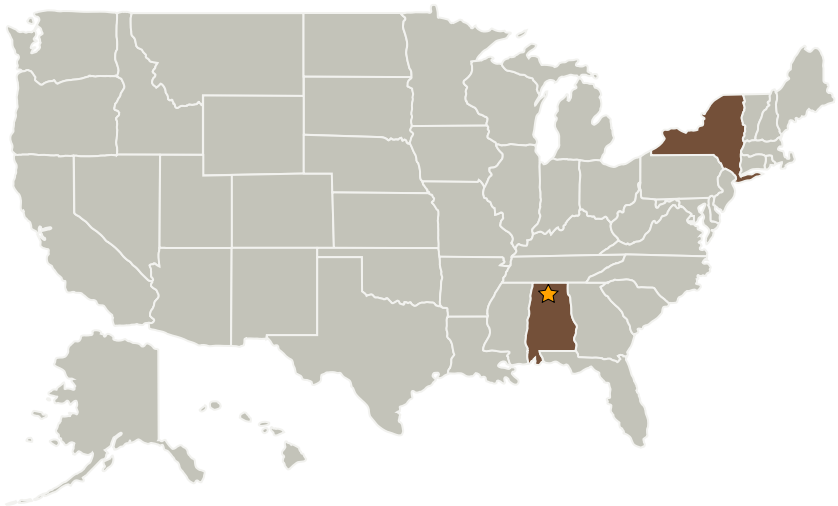
Gadolinium EUV Multilayers for Solar Imaging Near 60 nm, Phase II

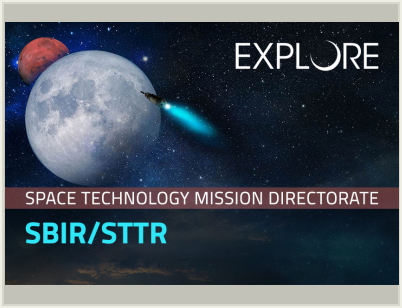
Completed Technology Project (2007 - 2009)

Project Introduction

We propose to develop and commercialize a new class of extreme ultraviolet (EUV) multilayer coatings containing the rare-earth element gadolinium (Gd), designed as efficient narrow-band reflective mirror coatings operating near normal incidence in the 60-65 nm wavelength range. This long-wavelength region of the EUV includes the important solar emission lines O V near l=63.0 nm and Mg X near l=61.0 nm, formed at intermediate temperatures in the solar atmosphere. While narrow-band EUV multilayer coatings are by now widely used in NASA missions for high-resolution solar imaging at wavelengths shorter than 35 nm, the observations made at those wavelengths probe coronal and transition region lines formed at either low (e.g., He II at l=30.4 nm) or high (e.g., numerous Fe lines) temperatures. In contrast, the 60-65 nm wavelength region provides a unique spectral window in which to observe intermediate-temperature solar emission lines. However, efficient narrow-band multilayer coatings operating in this range have been unavailable until now. The successful development of efficient, stable Gd-based multilayers as we propose, based on preliminary experimental results, especially those obtained during our Phase I effort, will therefore enable the construction of new high-resolution solar telescopes tuned to O V or Mg X that will complement existing multilayer telescopes tuned to shorter EUV wavelengths, thereby providing more complete temperature coverage, and leading to better understanding of the solar atmosphere, its variability, and its crucial role in driving space weather. EUV imaging instruments incorporating the multilayer technology we propose to develop may be included in future missions such as RAM, Solar Probe, and Solar Orbiter, as well as future GOES satellites and new Explorer-class missions.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Reflective X-Ray Optics LLC	Supporting Organization	Industry	New York, New York

Primary U.S. Work Locations	
Alabama	New York

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.5 Radiation
    - TX06.5.4 Space Weather Prediction